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Innovative Capacity of Firms: on why some firms are more innovative than others

by

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Abstract

In this paper we report a study into innovative capacity of UK SME firms. We argue that the ability of a firm to develop successful innovations is a function of their innovative capacity. We developed the concept in this paper and suggest it is largely determined by four sets of factors including culture, resources, competence and networks. The discussion first focuses on the background to the study. We then move on to characterise the factors influencing innovative capacity at the firm level. We formulate a model of innovative capacity and innovation performance. This allows us to draw a set of propositions regarding the drivers of innovation performance. Discussion then focuses on the research methodology where research design and methods of data collection are revealed. In the results section, we present the output of regression analyses conducted on our data set. This is followed by the discussion section and lastly the conclusion.

Keywords: culture, competence, innovative capacity, innovation performance, resources, networking.

1 Introduction

The work reported in this paper concerns the central problem of “why some firms are more innovative than others?”. A survey of the literature on innovation research have shown that there are no coherent answers to this question in the context of SMEs. In particular, the innovation research is divided into two broad areas of enquiry - economics-oriented and organisations-oriented. The economics-oriented research tradition (Dosi, 1988; Cosh and Hughes, 1996) have illuminated many of the innovation issues at the national and industrial levels looking at cross-country innovative patterns and inter-sectoral patterns of innovation, evolution of technologies over time and intra-sectoral propensity of firms to innovate. The industrial economists made significant contributions to the relationship between size of firm, market structure and innovative activity, nonetheless this research streams have provided inadequate answers to the above research problem (Geroski, 1994).

On the organisations-oriented camp, management scholars (Clark and Fujimoto, 1991; Leonard-Barton, 1992; Dougherty, 1992; Iansiti, 1997) studying the process of new product development have looked at innovation in firms by using (in the main) the case-method. This stream of research have generated some useful findings both descriptive – “how firms innovate” and explanatory – “why firms are able to introduce new products successfully”. While this stream of research provides finer details firm-level insights, by focusing on firm-specific innovations, the generability of these findings are weakened.

In this paper we argue that the problem of “why some firms are more innovative than others?” can be explained by the concept of ‘innovative capacity’. This concept has been developed from a survey of three streams of literature - theories of firm, literature on organisation studies and the literature on economic geography.

Theories of firm specifically the resource-based view argue that a firm is a bundle of resources, and competitive advantage accrues to firms with unique set of resources that are non-tradable in the markets. If one conceive of the firm as a collection of resources which render services, then innovation involves the combination of these resources into something new (products, process and services) to the firm. To innovate, a firm needs to perform a set of activities, the ability to perform these activities is related to its competence. Hence the ability to innovate is a function of resources endowed and competence of the firm in question.

Organisational theory argue that a firm needs the right strategy, structure, systems and people in

place for innovations to flourish. Specifically, there needs to be a right climate for stimulating

. Proposition 1: The levels of resources committed to innovation is positively associated with the firm's innovation performance.

innovation. This climate or culture of the firm is central to establishing the right strategy, structure, systems and people for developing and sustaining innovations. Therefore, culture of firm is key to the development of the resources and competence for innovation.

Work in the area of economic geography have shown the importance of external networks to knowledge flows in innovating firms. The notion of networks is compelling; this is complemented by work in NPD that shows the fifth generation innovation model as closely networked environment using IT enabling technologies (Rothwell, 1994). Regional economists argue that a firm does not exist in isolation, a firm is embedded in its regional environment. The ability of a firm to generate new ideas and access external ideas is dependent on its networking ability.

Synthesising the current state of knowledge from these three streams of research, one is able to identify the determinants of 'innovative capacity' as culture, resources, competence and networks. A firm's ability to innovate is determined by its internal potential to innovate - its innovative capacity. It follows from the above that given a set of firms, one would expect to observe differences in terms of innovation performance. And this difference is a manifestation of their differences in innovative capacities. It remains in this paper to ascertain if the key determinants identified are adequate to explain the differences observed.

2 Conceptual Model

2.1 Resources and competence

The resource-based approach (Penrose, 1959; Wernerfelt, 1984; Teece et al., 1990; Barney, 1991) starts by departing from the mainstream neo-classical economists' view of a firm. Penrose (1959) argues that a firm should be conceived, firstly as a bundle of 'productive resources', secondly, as an 'administrative framework' linking and co-ordinating the activities of individuals and groups within the firm for productive purposes. It is this conception of the firm as a 'bundle of productive resources' that holds the potential and intellectual appeal for explaining the dynamics of innovation. New products and services are generated on the basis of managerial capacity in responding rapidly to opportunities in the market.

We argue that the range of products and service offered by a firm is a function of its portfolio of resources and capabilities. In this paper we define resources as per Barney (1991) where firm resources are categorised into 3 groups: physical resources, human resources and organisational resources. Resources are therefore inputs for the production process, we include new ideas as a fourth category of resources. Capabilities then refers to the ability to co-ordinate and deploy these firm resources for performing tasks. In this paper we use competence to refer to a set of capabilities necessary for conceiving and implementing innovations.

Innovation is in essence different combinations of existing sets of resources. Managers ability to implement innovations is therefore a function of resources endowed and the set of capabilities within the firm. Therefore the internal capacity of managers to leverage resources is a prerequisite for creating new businesses and innovations. In line with this, the OECD suggests that the task of management is to constantly develop capabilities within the firm and to constantly scan the market for opportunities that can be exploited with existing firm capabilities. "The capabilities of the firm lie in its engineering, design, research and marketing resources and assets. Opportunities and capabilities must be combined in an innovative or technological strategy, which is where the management and organisation of the firm enter the picture" OECD(1992: 16).

Hence we can generate the following propositions:

Proposition 2: The levels of competence in innovation is positively associated with the firm's innovation performance.

2.2 Culture

The ability of a firm to continuously improve and innovate is contingent upon the skills and knowledge set of its employees. The managerial systems of a company, its rewards, incentives and training system shape the generation and accumulation of knowledge of the employees. The incentive system in particular serves as a channelling and controlling mechanisms that influences behaviours of employees towards knowledge creating activities. Managerial systems of a firm constitute a set of routines that guide resource allocation and deployment which has a severe influence on the development of firm capabilities. Incentive and educational programs and promotional practices can induce beneficial behaviours specific to a firm.

The skills and knowledge embedded in physical systems and the managerial systems of a firm is shaped by the firm culture. Hence, culture of the firm plays a key role in development of firm capability. It influences the 'way things are done' within the firm and the relationships among the employees and how they relate to each other. Firm culture determines what kinds of knowledge is valued and hence sought after by employees and these contribute to the capabilities that distinguish the firm from its competitors. The firm culture influences what skills are acquired and retained within a firm. Innovative ideas require a receptive climate for successful gestation and implementation. Hence, firm culture serves as an effective social control system that mediates the climate within the firm, stimulating and promoting innovations.

Hence we can formulate the following:

Proposition 3: Innovation performance of a firm will be positively associated with the strength of the culture in promoting innovations.

2.3 Networking and innovation

For scholars interested in innovation, the firm's linkages to external networks and its relations to customers have been shown to be important for innovation (Von Hippel, 1988; Lundvall, 1988). Adler and Shenbar (1990) use the term 'external assets' to describe a firm's linkages to the environment. They delineate 3 specific linkages that a firm could foster: (1) Downstream links to customers: This relates to the amount of access a firm has over customers' decision-makers. Also the extent to which the firm learns from the customers, since customers can provide precious new ideas. (2) Upstream links to materials and component suppliers, equipment vendors and relevant sources of scientific and technological knowledge: this relates to how well the firm has formed appropriate links with best people in the field and whether those relationships are sufficiently collaborative. (3) Horizontal links through alliances, industry associations and informal networking: these linkages can provide substantial knowledge to trigger the development of the firm's technological assets (reproducible capabilities in product, process, and support areas).

In similar spirit, regional economists when studying the phenomenon of innovative milieu have come to the conclusion that 'networking' is an effective mechanism for innovation (Camagni, 1991; Saxenian, 1994; Cooke and Morgan, 1994). Learning through networking is increasingly important as a mechanism for building knowledge of a firm. This is best summarised by Freeman (1994:470). "The picture which thus emerges from numerous studies of innovation in firms is one of continuous interactive learning. Firms learn from both their own experience of design, development, production and marketing... and from a wide variety of external sources at home and abroad - their customers, their suppliers, their contractors..., and from many other organisations - universities, government laboratories and agencies, consultants, licensors, licensees and others.

Proposition 1: The levels of resources committed to innovation is positively associated with the firm's innovation performance.

They also learn from their competitors through informal contacts and reverse engineering.”

This discussion allows us to formulate our last proposition:

Proposition 4: The degree of networking as measured by the extent to which managers access knowledge through networks is positively associated with the levels of innovation performance.

2.4 Innovative capacity of firms

We have developed the concept of 'innovative capacity' to explain the differences in innovation performance of firms. A firm is endowed with a set of resources due to history, but to adapt and innovate, management must enact the right firm culture, develop the resources and capabilities constantly and forge links with external environment for new ideas. To further our argument, a definition is in order. We define the innovative capacity of a firm as *its internal potential to generate new ideas, identify new market opportunities and implement marketable innovations by leveraging on existing resources and capabilities*. The conceptual model underpinning this study is as shown in Figure 1.

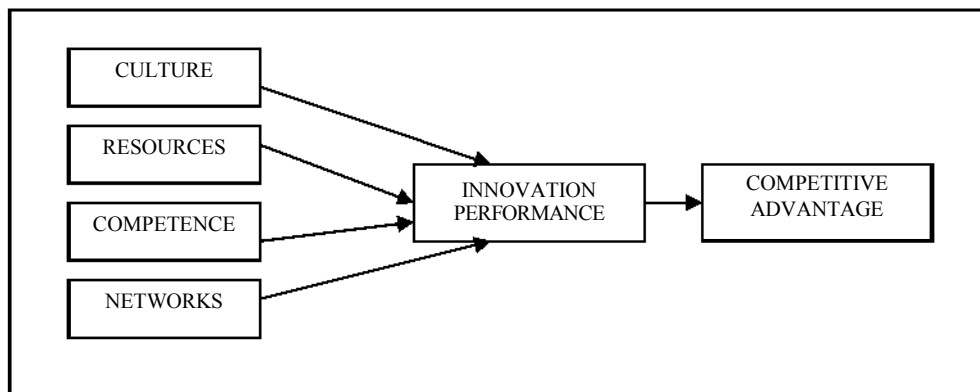


Figure 1 Analytical Framework

3 Research Methodology

3.1 Sample

The sample was drawn from SMEs within the region of East of England. They were all spread across seven key sectors: 1. Agriculture and Food Processing, 2. Automotive Manufacturing, 3. Pharmaceuticals and Biotechnology Manufacturing, 4. High-Tech Manufacturing, 5. Information and Communications Technology, 6. Financial and Business Services (including R&D) and 7. Media and Cultural Industries. We specify two main criterion for selection of firms, first, they must be located within the region of East of England. Second, the size of firms ranges from 10 to 250 employees. The basis for the criteria is that this work is sponsored by the East of England Development Agency which is interested in how innovation can be fostered in SMEs within their region.

3.2 Data collection

The data was collected through mail-out questionnaires. (Questionnaires available from authors). There were in total 30 questions in the survey. These were sent to 1800 firms in the region. Accompanying each questionnaire was a cover letter explaining the purpose of study and benefits of participation. Participating firms were asked to draw from experts or senior managers who have worked on innovation issues for within the past three years. These individuals typically included the Managing Director, Technical Director, Marketing Director, R&D Manager, Business Development Manager and Engineers.

3.3 Measures

The following are descriptions of the measures for each constructs.

Culture corresponds to the extent to which a firm support innovations. This construct is measured by six items including strategy, leadership and support, company style, risk-taking, measurement systems and incentives systems.

Resources relate to four categories, financial, intellectual, human and physical. This construct is measured by five items. The questions probed for the extent to which there is sufficient resources in place to support innovation initiatives.

Competence relates to the range of capabilities within a firm that support innovation. This construct is measured by six items including new idea generation, project management, market knowledge, technical knowledge, experimentation and problem solving skills.

Networking is measured by six items representing customers, suppliers, competitors, importing know-how, knowledge institution and information search. This construct relates to the extent to which a firm makes use of networking for innovations.

Innovation performance is measured by three items – product innovativeness, process innovativeness and organisational innovativeness. Respondents are asked to reply to questions on the number of significant innovations their firm has introduced over the last three years. Essentially innovation performance is operationalised as number count of product, process and organisational innovations.

4 Results

Table 1 and Table 2 presents the means, standard deviations and correlations among the variables. In addition to the correlations presented, the propositions are tested by the use of ordinary least squares regression analyses. The results are reported in Table 3.

Proposition 1: Resources

There is a moderate correlation (0.35) between resources and innovation performance ($p < 0.05$). The regression results in Table 3 shows that there is a negative and significant beta for resources in the model. Thus the results offer only *moderate support* for the first proposition.

Proposition 2: Competence

There is a very strong correlation (0.516) between competence and innovation performance ($p < 0.01$). However, regression results show that there is a positive and significant beta for competence. This results offer *support* for proposition 2.

Proposition 3: Culture

There is a very strong correlation (0.57) between culture and innovation performance ($p < 0.01$). Regression results suggest a positive and very significant beta for culture. Proposition 3 is *strongly supported*.

Proposition 4: Networking

There is a moderate correlation (0.369) between networking and innovation performance ($p < 0.01$). The beta for networking is very low and insignificant. Proposition 4 is *rejected*.

Descriptive Statistics

	Mean	Std. Deviation	N
CULTURE	3.7469	.8060	49
RESOURCE	2.7245	1.1230	49
COMPENTE	3.5673	.7318	49
NETWORK	3.5816	.7242	49
PERF	.9142	.6330	49
LGPDT	1.3273	.8770	44
LGPROC	1.1910	.7279	36
LGORG	.7885	.6360	42

Table 1

Correlations

		CULTURE	RESOURCE	COMPENTE	NETWORK	PERF	LGPDT	LGPROC	LGORG
CULTURE	Pearson Correlation	1.000	.760**	.797**	.668**	.570**	.561**	.475**	.339*
	Sig. (2-tailed)	.	.000	.000	.000	.000	.000	.003	.028
	N	49	49	49	49	49	44	36	42
RESOURCE	Pearson Correlation	.760**	1.000	.705**	.677**	.350*	.210	.341*	.176
	Sig. (2-tailed)	.000	.	.000	.000	.014	.172	.042	.265
	N	49	49	49	49	49	44	36	42
COMPENTE	Pearson Correlation	.797**	.705**	1.000	.669**	.516**	.472**	.457**	.393*
	Sig. (2-tailed)	.000	.000	.	.000	.000	.001	.005	.010
	N	49	49	49	49	49	44	36	42
NETWORK	Pearson Correlation	.668**	.677**	.669**	1.000	.369**	.345*	.101	.174
	Sig. (2-tailed)	.000	.000	.000	.	.009	.022	.559	.271
	N	49	49	49	49	49	44	36	42
PERF	Pearson Correlation	.570**	.350*	.516**	.369**	1.000	.855**	.835**	.726**
	Sig. (2-tailed)	.000	.014	.000	.009	.	.000	.000	.000
	N	49	49	49	49	49	44	36	42
LGPDT	Pearson Correlation	.561**	.210	.472**	.345*	.855**	1.000	.561**	.538**
	Sig. (2-tailed)	.000	.172	.001	.022	.000	.	.001	.001
	N	44	44	44	44	44	44	32	37
LGPROC	Pearson Correlation	.475**	.341*	.457**	.101	.835**	.561**	1.000	.629**
	Sig. (2-tailed)	.003	.042	.005	.559	.000	.001	.	.000
	N	36	36	36	36	36	32	36	33
LGORG	Pearson Correlation	.339*	.176	.393*	.174	.726**	.538**	.629**	1.000
	Sig. (2-tailed)	.028	.265	.010	.271	.000	.001	.000	.
	N	42	42	42	42	42	37	33	42

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

Table 2

Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
		1	(Constant)	-1.112			.478		-2.329
	CULTURE	.450	.179	.572	2.515	.016	.570	.355	.303
	RESOURCE	-.142	.113	-.252	-1.256	.216	.350	-.186	-.151
	COMPENTE	.208	.184	.241	1.135	.263	.516	.169	.137
	NETWORK	-3.83E-03	.156	-.004	-.025	.980	.369	-.004	-.003

a. Dependent Variable: PERF

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.600 ^a	.361	.302	.5287	.361	6.201	4	44	.000	2.269

a. Predictors: (Constant), NETWORK, CULTURE, RESOURCE, COMPENTE
 b. Dependent Variable: PERF

Table 3

5 Discussion

It is our objective to answer the question “why some firms are more innovative than others”. Through the analytical lens of innovative capacity we were able to distil the key drivers that influence firm’s innovation performance. Defining innovative capacity as a firm’s internal potential for generation of new ideas and implementation of innovations. We were able to test our research model empirically using survey data. We found support for three of the propositions put forth in this paper. Our predictions with respect to networking and its impact on innovation performance were not borne out by our initial results. There is a need for further work in this area.

The first proposition offers mixed results. We found resources to be correlated with innovation performance, but the regression results showed that resources displayed negative relationship with respect to performance. This would imply that as resources increase, innovation performance is predicted to be decreasing. Further investigation is needed; it could be a case that since most of our sample are small firms, resource limitations are a given, hence culture and competence would be better predictors of innovation performance. One way to account for this would be to control for the size of firms. This we hope to report in the conference.

The second proposition states that the competence of a firm is positively associated with innovation performance. This we found support from our data. Correlation between competence and performance was very strong and regression results showed positive relationship. Our predictions that innovation performance is related to firm’s competence is borne out by the results.

Culture was found to be significantly influencing innovation performance. This offers very strong support for our third proposition. Specifically regression results showed culture to be a strong predictor of innovation performance.

We reject our last propositions on grounds that correlation was low and regression coefficient was insignificant. This came as a surprising result to us, as we have predicted that SMEs would need to draw on external ideas and expertise for new innovations given inhouse resource limitations. One plausible explanation could be due to time constraints for the sets of activities we defined as ‘networking’.

6 Conclusions

The notion of capabilities is useful in the discussion of innovation. A firm requires a set of capabilities in order to exploit innovative ideas that emerges within the firm. How a firm builds its capabilities for innovation and how its distinctive capabilities shape managerial action is relatively underdeveloped in the literature. Verona (1999) in an article on resource-base view and new product development specifically highlighted this gap in the current literature. Our work is an attempt to contribute to knowledge in this area. In this paper, we examined the concept of innovative capacity and its strength in explaining innovation performance. Given that this work is largely exploratory, we found support for three main propositions from our research model and we rejected the last proposition on networking.

On why some firms are more innovative, we can only suggest at this stage that innovation performance is influenced by a broad set of factors including culture, resources and competence. We hope this research has helped put a structure on those factors that matter. This research is largely an ongoing work in progress. We are currently going through a second wave of data collection with refined instrument drawing on the lessons learned in the first study. We hope to be able to present the new set of data and analyses in the coming EurOMA conference.

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